IT Infrastructure-Monitoring Tools

Josune Hernantes, Gorka Gallardo, and Nicolás Serrano

Clients often ask me, what's the cost of our IT services? How do they map to different applications? What are the availability and performance of our services in geographically dispersed centers? How can we effectively reduce the total cost of ownership while improving service quality? A good starting point is to actively use IT-monitoring technology. It provides a quantitative starting point that—with a good understanding of IT systems and service needs—facilitates improving your IT performance. In this installment, Josune Hernantes, Gorka Gallardo, and Nicolás Serrano provide an overview of recent monitoring technologies. I look forward to hearing from both readers and prospective column authors about this column and the technologies you want to know more about. —Christof Ebert

PROVISIONING NEW INFRASTRUCTURES and applications has never been so easy. Virtualization and cloud computing have made this process routine. The result for enterprises' IT infrastructure has been an increased number of diverse elements to manage. Furthermore, nowadays systems are usually geographically dispersed or use different OSs, which complicates their management. This situation has renewed the importance of an old topic: monitoring IT infrastructures and applications.

Also, as more businesses rely on software, IT system health is critical for 24/7 customer service and support. The systems can be on-premise applications, applications on a public or private cloud, or any combination of these.

The first step in this process is monitoring the IT infrastructure at the hardware, service, and application levels. Figure 1 describes the architecture.

Here, we discuss current tools that monitor networks to detect issues, ensure the components' availability, and measure the resources those components use.

Selecting Tools

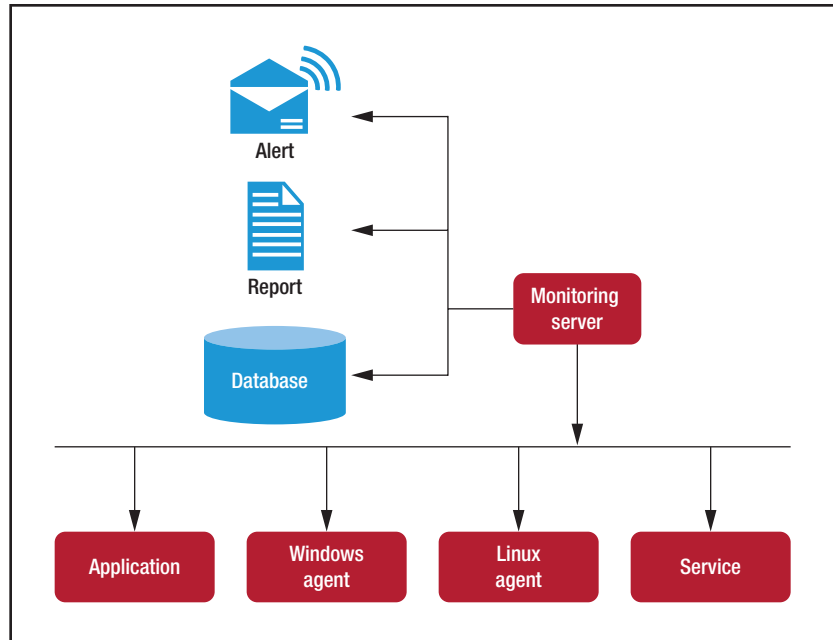When selecting an infrastructure-monitoring suite, you need to take

into account several factors to find the perfect match for your needs. First, select a tool on the basis of the required functionalities so that it aligns with your technical and business needs. Next, evaluate the deployment and maintenance factors to match the tool with your IT team's resources and capabilities. Finally, with a proper understanding of how the tool will affect your organization, calculate the total cost of ownership.

Functionality

From a functionality perspective, understanding the needs of the different users (development, IT operations, and so on) is important. For example, a business decision maker might be more interested in having service-level-agreement data reports, which from a technical viewpoint might be more valuable for detecting performance issues and their origins. The layers to evaluate are numerous, and the tool should support the front and back ends, letting you detect all sorts of problems from slowdowns and crashes to memory leaks.

User interfaces. Infrastructure-monitoring tools have been available for a long time. On one hand, this means you can rely on well-proven suites. On the other hand, you might find that the tools' UIs are outdated. Evaluate whether the tools suit your needs. Moreover, depending on the users' skills and profile, you might need to either find a tool with a Web interface to guarantee access from heterogeneous clients, or look for a mobile UI if you primarily use mobile devices.

Alerts, help desk integration, and automation. A goal of any monitoring system is to respond as soon as

FIGURE 1. An infrastructure-monitoring architecture. The IT infrastructure must be monitored at the hardware, service, and application levels.

possible to problems. Consequently, you might want to act when degradation occurs. So, a customizable alert service might be your best ally. When comparing systems, you might look at

- different alert methods (short message service [SMS], email, custom scripts, and so on),
- the customization needed,
- the supported OSs, and even
- integration into your help desk system so that you can seamlessly integrate the monitoring system into your bug resolution processes.

As you gain knowledge of your infrastructure, you might automate tasks on the basis of events to keep problems under control.

Deployment and Maintenance

First, the deployment method should align with corporate policies. Next, the tool should be compatible with your languages, infrastructure, and IT department capabilities. Then, evaluate the methods that will help you collect the measures and data that represent insightful information. Toward that end, there are several ways to monitor performance, based on where this information is generated. For example, the monitoring information can be generated directly from code, logs, installed clients, and hardware devices.

Also, assess the installation and maintenance effort. Because all monitoring tools should be tailored to the business and application needs, installation and configuration are important in any implementation project. Take into account easy-deployment characteristics such as automatic discovery of application topology, and evaluate your team capabilities and resources.

TABLE 1

Eight popular IT-monitoring tools.

Tool	License	Support	User interface	Alerts	Web or mobile client	Help desk integration	Automation	OS support	Target business size	Strengths
Nagios	Open source (GPL*)	Active support community	Improved Web GUI†	Email, SMS*, custom	Web interface	Yes	Yes†	Linux, Unix, Windows via proxy agent	Small, medium, and large	Flexible and highly configurable, robust and reliable
Zabbix	Open source (GPL)	Active support community, email, forums, help desk, phone, wiki	Well-designed Web GUI	Email, SMS, custom	Web interface	Yes	Yes with API	Windows, Mac, Linux, Unix	Enterprise	Flexibility to organize monitoring data, configurability, scalability
Hyperic	Open source (GPL v2)	Support community, email, help desk	Good Web interface	Email, SMS	Web interface	Yes	Yes†	Windows, Mac, Linux, Unix	Small and medium	Native management for Unix, Linux, Windows, and Mac; scalability
Solar-Winds	Proprietary	Active support community, email, forums, help desk, phone	Excellent GUI	Email, custom	Web interface, mobile	Yes	Yes	Windows, Mac, Linux, Unix	Small and medium	Quick and easy deployment, affordability, native support for VMware
Manage-Engine OpManager	Proprietary	Email, forums, help desk	Unconventional UI that's hard to navigate	Email, custom	Web interface, mobile	Yes	Yes	Windows, Mac, Linux, Unix	Small and medium	Great feature set
HP Operations Manager	Proprietary	Forums, help desk, webinars	Good Web interface	Email, SMS, custom	Web interface, mobile	Yes	Yes	Windows, Linux, Unix	Large	Integration with other products from the same company; integration with HPIC, which can integrate with SCCM or SCOM.*
IBM Tivoli	Proprietary	Email, forums, help desk	Good, intuitive Web interface	Email, SMS	Web interface	Yes	Yes	Windows, Linux, Unix	Enterprise	Automatic analysis and repair, efficient where many resources must be monitored
WhatsUp Gold	Proprietary	Phone, email, forum	Clumsy interface	Email, SMS, sound	Web interface	Yes	Yes	Windows	Small, medium, and large	Easy setup and network discovery, great feature set

* GPL is GNU General Public License, SMS is short message service, HPIC is HP Insight Control, SCCM is System Center Operations Manager, and SCOM is System Center Operations Manager.

† Only in the paid version.

Cost

Cost is always important; a quick return on investment should be your goal. Consider the total cost of ownership—for example, to compare a software-as-a-service deployment with an on-premise alternative, for which licensing and hardware costs could add up quickly.

Eight Popular Tools

Here, we look at eight of the most popular IT-monitoring tools[1,2] (see Table 1).

Nagios

Nagios is one of the best-known open source tools for monitoring IT infrastructures such as end-user stations, IT services, and active network components. It has a free open source version, Nagios Core, and a paid version, Nagios XI. Many features aren't available on Nagios Core. Nagios XI provides an updated, easy-to-navigate Web interface that improves on Nagios Core's poor interface. This improved interface features an interactive dashboard that includes a high-level overview of hosts, services, and network devices. It provides trending and capacity-planning graphs that let organizations plan infrastructure upgrades.

Installation is easy, but management of configuration files to run devices and tests has a steep learning curve.

Nagios has a large, active support community that develops additional plug-ins. These plug-ins solve some of the tool's limitations, such as difficult configuration and the lack of automatic device discovery. Another example is the support of virtual environments.

Zabbix

Zabbix is open source software that offers great performance for data gathering and can scale to large environments. It allows monitoring servers, network devices, and applications, gathering accurate statistics and performance data.

It's easy to install, but configuration can be complex, particularly to add new or custom checks. Zabbix has a well-designed Web GUI and extensive reporting and graphing capabilities as part of the standard package, which combines monitoring and trending functionalities. Zabbix can deliver email or SMS notifications informing network administrators when the acceptable limits are exceeded. Like Nagios, Zabbix has an active support community.

Hyperic

Hyperic is monitoring and management software optimized for virtual environments, as it's a VMware initiative. It has a free open source version, Hyperic HQ, and a paid version, vFabric Hyperic. It efficiently manages any OS, Web, app, or database server. vFabric Hyperic adds functionalities such as automated corrective actions.

Installation is easy and takes only minutes. Hyperic provides a well-designed, customizable UI. For example, you can save the dashboard and edit it to include frequently used graphs.

Alerts can be configured as SMS or email, and administrative actions can be configured to run in response to them. Hyperic can automatically discover, monitor, and manage software and network resources. It too has an active support community.

Hyperic's main disadvantage is the higher amount of resources used by the Java virtual machine, compared to other monitoring tools.

> Traditional infrastructure monitoring will soon be replaced by application performance management.

SolarWinds

SolarWinds is available as a self-hosted solution and as software as a service. Installation takes from several minutes to a few hours, depending on the complexity of the configuration data, such as tickets or locations. SolarWinds can be deployed using only internal staff and can easily scale to large organizations. It also provides native VMware support and has great community support, provided by Thwack (https://thwack.solarwinds.com).

Its user interface is intuitive, with customizable forms and mobile access. Detailed graphs depict network failures, availability, and performance. You can easily configure alerts and define complex rule-based workflow. SolarWinds provides preconfigured dashboards you can change to suit your needs. Furthermore, it creates customized reports that can be automated according to a schedule.

ManageEngine OpManager

OpManager's installation is fast and

easy, but configuration is manual and can be complex. Administrators can automate routine maintenance and troubleshooting.

OpManager provides several dashboard views that can be customized, although navigating the UI is difficult. The tool generates many types of reports and can set threshold alarms to trigger notification through email, SMS text, and

IBM Tivoli

Installation of Tivoli is easy and takes just a few minutes, although configuring, updating, and refining the analytical and response features require IT expertise.

Tivoli offers an intuitive Web interface with customizable workspaces and includes an easy-to-use data warehouse and advanced reporting capabilities. It provides dy-

ure alerts (email, SMS, or custom scripts) for when the software detects that a device has exceeded a threshold.

Future Trends in Monitoring Tools

As the cloud's popularity grows, cloud-based solutions are becoming common for most enterprise applications.[3] Cloud-based infrastructure monitoring can ease installation and maintenance, but data privacy and control concerns will arise. As usual, selecting a deployment method will be based on corporate policies. But technical restrictions might also apply; your application deployment method (on-premises, public cloud, private cloud, hybrid cloud, and so on) might affect your selection because not all providers will be compatible.

> Cloud-based infrastructure monitoring can ease installation and maintenance but cause privacy and control concerns.

custom scripts. It has three levels of thresholds: Warning, Trouble, and Error. OpManager offers several plug-ins as separate products.

HP Operations Manager

HP Operations Manager is the central component of the HP monitoring suite. It's a client–server solution with agents required on each node. The initial setup can be complex if you want to install multiple suites.

HP Operations Manager has an excellent GUI for monitoring application, system, and network health. It provides planning features including predictive analysis and datacenter modeling. You can filter alarms by severity or node type. The tool offers proactive monitoring and automated alerting. It adds resolution information to events to advise operators on a recommended remediation approach, and it includes predefined tools and automated actions to fix processes.

namic thresholding and performance analytics to improve incident avoidance. It features proactive monitoring and automated fault management. It also collects monitoring information for reporting, performance analysis, and trend prediction.

IBM offers free phone and email support during business hours, and extensive access to product documentation and a user knowledge base.

WhatsUp Gold

Installing WhatsUp Gold is easy, but configuration requires using both the Web console and Windows application. This tool provides more than 200 configurable reports, including historical data for trend analysis. Real-time reports are available, which are helpful for troubleshooting. Several plug-ins are available to expand WhatsUp Gold's features.

The UI can be clumsy for simple functions, such as reporting on specific elements. You can config-

Finally, traditional infrastructure monitoring will soon be replaced by application performance management because the performance of internal and external applications can greatly affect business profitability. Application responsiveness is vital and can affect business processes and customer retention. At the same time, increased uncertainty and the need to bring value earlier are encouraging agile development methodologies with a faster software release cycle. In this scenario, software quality can't be measured only by pure functionality (passing the tests) because continuous delivery might decrease performance. Traditional IT infrastructure management will make room for a DevOps view, in which IT infrastructure is important throughout application development and application-performance-management tools add value throughout the software-engineering life cycle.

For a look at a real-world example of a company selecting and implementing IT-monitoring tools, see the sidebar. 𝕊𝕎

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JOSUNE HERNANTES is a professor of computer science and software engineering at the University of Navarra. Contact her at jhernantes@tecnun.es.

GORKA GALLARDO is a professor of information systems at the University of Navarra. Contact him at ggallardo@tecnun.es.

NICOLÁS SERRANO is a professor of computer science and software engineering at the University of Navarra. Contact him at nserrano@tecnun.es.

A CASE STUDY INVOLVING IT-MONITORING TOOLS

An electronic-components e-commerce company with a presence in Europe and the US wanted to increase IT availability and performance, which directly affect its profitability. It needed to ensure availability of its internal IT resources such as email, enterprise resource planning, and its e-commerce site. Any downtime on IT resources directly affects both internal and external stakeholders. So, the quick resolution of incidents or even avoiding them with proactive IT management is an important business goal.

The company had been using three IT-monitoring tools; each department had implemented its own solution that had a limited scope and responded to an urgent need. By implementing a unified suite, the company expected to increase collaboration and reduce resolution time.

The infrastructure consisted of datacenters with more than 50 servers. The suite needed to monitor SQL, disk space, memory, whether the host was up or down (via ping), log files, email service, and transaction performance on the basis of load time. When selecting the suite, the company considered functionalities and total costs (for licenses, hardware, configuration, training, maintenance, and so on). Because the IT staff had no experience with the suite, training different user roles was a priority during implementation.

A main objective was to reduce the resolution time of any incident because downtime directly affects the bottom line and customer satisfaction. So, during implementation, the company devoted considerable effort to setting up an alert system that was integrated with its ticketing system. The alert system automatically reroutes each event to the most relevant support area and level. Moreover, the configuration includes a fair amount of automation, with automatic server reboots and automatic provisioning of virtual instances based on puppets and scripts.

With this new proactive management of the infrastructure, the company has reduced service desk tickets by more than 30 percent. However, the benefits have gone beyond reduced support costs and increased availability. Now, the IT department can easily accommodate increasing demand and objectively justify investment in new infrastructure, and management staff can easily access service-level-agreement information.